

Washington State Status Report for the Olympic Mudminnow



by Paul E. Mongillo and Molly Hallock



Washington Department of
FISH AND WILDLIFE
Fish Program
Freshwater Division

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for the
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October 1999

The Washington Department of Fish and Wildlife maintains a list of endangered, threatened and sensitive species (Washington Administrative Codes, Appendix E). In 1990, the Washington Fish and Wildlife Commission adopted listing procedures developed by a group of citizens, interest groups, and state and federal agencies (Washington Administrative Codes, Appendix E). The procedures include how species listing will be initiated, criteria for listing and de-listing, public review and recovery and management of listed species.

The first step in the process is to develop a preliminary species status report. The report includes a review of information relevant to the species' status in Washington and addresses factors affecting its status including, but not limited to: historic, current, and future species population trends, natural history including ecological relationships, historic and current habitat trends, population demographics and their relationship to long term sustainability, and historic and current species management activities.

The procedures then provide for a 90-day public review opportunity for interested parties to submit new scientific data relevant to the status report, classification recommendation, and any State Environmental Policy Act findings. During the 90-day review period, the Department holds statewide public meetings to answer questions and take comments. At the close of the comment period, the Department completes the Final Status Report and Listing Recommendation for presentation to the Washington Fish and Wildlife Commission. The Final Report and Recommendation are then released 30 days prior to the Commission presentation for public review.

This is the Final Status Report for the Olympic mudminnow. **Submit written comments on this report by November 30, 1999 to: Endangered Species Program Manager, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia, WA 98501-1091.** The Department will present the results of this status review to the Fish and Wildlife Commission for action at its December 10-11, 1999 meeting.

This report should be cited as:

Mongillo, P.E. and Hallock, M. 1999. Washington state status report for the Olympic mudminnow. Wash. Dept. Fish and Wildl., Olympia. 36 pp.

Cover photo by Paul Mongillo

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EXECUTIVE SUMMARY

The Olympic mudminnow is one of five species worldwide in the family Umbridae and is the only member of the genus *Novumbra*. Three other species are found in North America and one in eastern Europe. Olympic mudminnows are found only in Washington State. No other members of the family Umbridae are found in Washington.

The current distribution of the Olympic mudminnow includes the southern and western lowlands of the Olympic Peninsula, the Chehalis and lower Deschutes River drainages, and south Puget Sound, west of the Nisqually River. They are usually found in slow-moving streams, wetlands and ponds. Within these habitats, mudminnows require a muddy bottom, little or no water flow and abundant aquatic vegetation.

Spawning occurs over an extended period from late November to the following June. Mature mudminnows are about 50 mm (2 in) to 75 mm (3 in) long. Males become brightly colored and aggressive during spawning. Females deposit eggs in vegetation and they hatch in approximately ten days.

Little is known about mudminnow mortality. However, they are less abundant when associated with both native and exotic species of fish. It is not known whether this is a result of competition or predation, but some combination is likely. Mudminnows are carnivorous and they eat a various assortment of invertebrates.

Wetland loss in Washington since settlement is estimated to range from 20 to 50 percent. In one part of the mudminnow's range an estimated 55 percent of wetlands have been destroyed. There were likely many more mudminnow populations before settlement of Washington because much more wetland habitat was available. There are now a myriad of federal, state, county and city wetland regulations. The rate of loss has been reduced, but despite the regulations there are still losses of 280 to 800 ha (700 to 2000 ac) each year.

Nearly 90 percent of the mudminnow populations monitored in this study seem to be stable. However, mudminnows are completely dependent on healthy wetland habitat for their survival. Because of this, and the Olympic mudminnow's very restricted range and the continuing loss of wetlands, we believe they are vulnerable and likely to become threatened or endangered in a significant portion of its range without cooperative management. The Department of Fish and Wildlife recommends that the Olympic mudminnow be designated as a sensitive species in Washington.

TAXONOMY

Olympic mudminnows (*Novumbra hubbsi*) were first described by Schultz (1929) from a drainage ditch near Satsop, Washington. They belong to the family Umbridae, order Salmoniformes, suborder Escoidei. There are four species from this family in North America and one in eastern Europe and Asia. The Olympic mudminnow is the sole surviving member of its genus, *Novumbra*. *Novumbra* contains one other species which is only known from fossil records (Cavender 1969).

DESCRIPTION

Under normal conditions, the Olympic mudminnow is a rather drab colored fish, olive-green with faint vertical bars on its sides and a slightly lighter belly. However, during breeding season, the male becomes quite colorful. Its body color darkens to chocolate brown or black, and about 15 vertical bars form on its sides that range from an iridescent green to a white or blue. The dorsal and anal fins usually have sky blue edging, but may be yellow or white (Hagen et al. 1972). The color intensity varies and can be very brilliant.

Olympic mudminnows are also characterized by soft dorsal and anal fins of about equal length, both of which are set far back on the body. They have a truncated or slightly indented caudal fin and lack a lateral line. The upper jaw is nonprotractile and there is no groove between the lip and the snout (Wydoski and Whitney 1979).

Washington Department of Fish and Wildlife (WDFW) measured 1307 Olympic mudminnows. They averaged a total length of 52 mm (2.05 in), with a maximum length of 88 mm (3.46 in) and a minimum length of 22 mm (.86 in). Hagen et al. (1972) measured 61 males that averaged 53.6 mm (2.11 in) and 74 females that averaged 54.4 mm (2.18 in).

GEOGRAPHIC DISTRIBUTION

North America

The Olympic mudminnow is found only in Washington State.

Washington

Current distribution of the Olympic mudminnow includes the southern and western lowlands of the Olympic Peninsula, the Chehalis and lower Deschutes River drainages, and south Puget Sound lowlands west of the Nisqually River (Fig. 1). This distribution was dictated by the glacial history of western Washington during the Pleistocene Era (Crandell 1965, McPhail 1967, Meldrim 1968). Both the Chehalis River and Lake Ozette were ice free during the last glaciation and provided refugia for Olympic mudminnows as well as many other species. Mudminnows

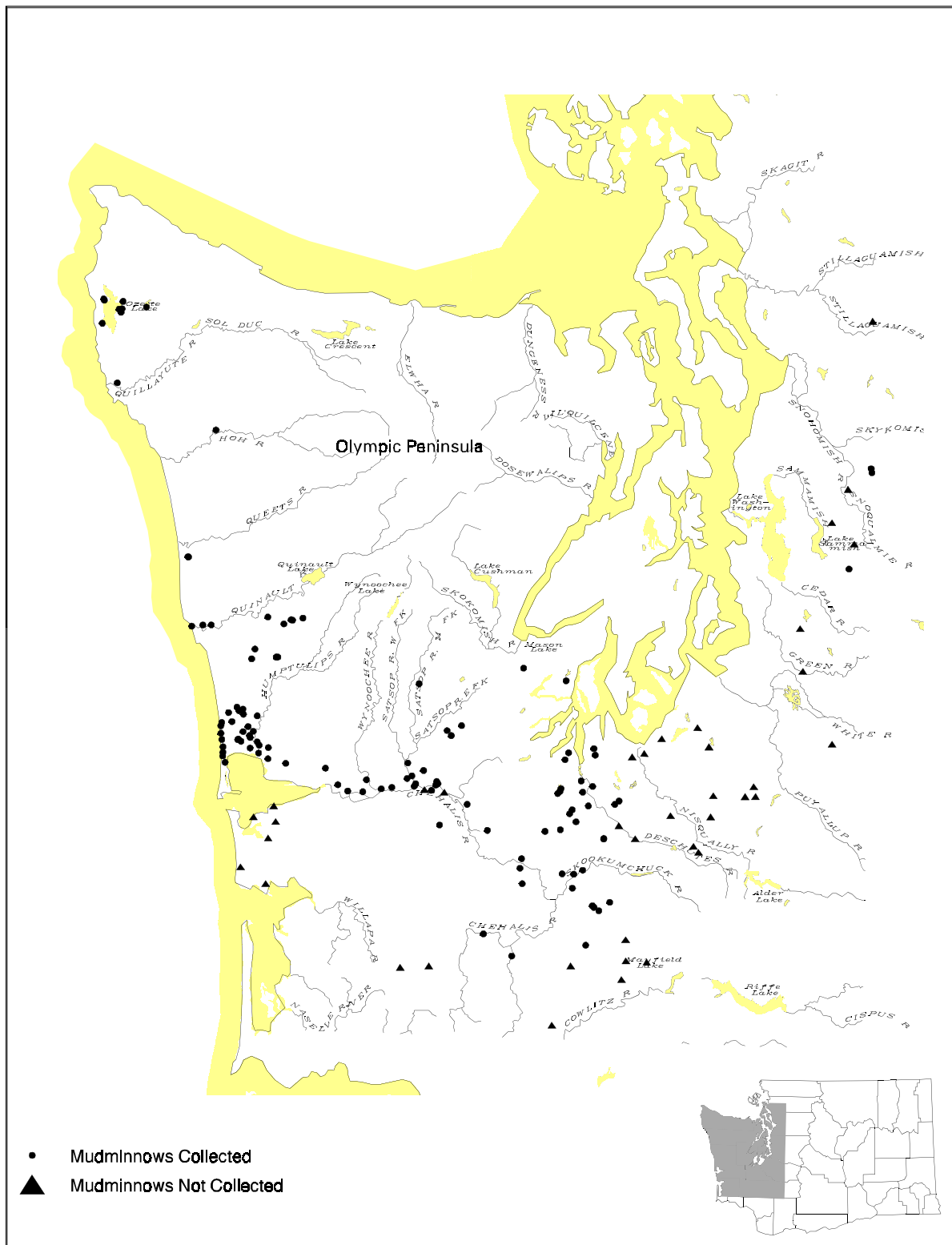


Figure 1. Distribution of Olympic mudminnow collection sites and collection efforts in Washington.

dispersed to suitable habitats as ice receded 14,000 years ago. Mudminnows are intolerant of salt and avoid current (Meldrim 1968). These two variables limited dispersal as ice receded. Mudminnows were never documented in the drainages between the Queets River and Lake Ozette until this investigation.

Olympic mudminnows have recently been observed in the Cherry and Issaquah Creek drainages in Snohomish and King Counties (Trotter et al. 1998). WDFW does not consider these observations as natural extensions of the Olympic mudminnow's range for three reasons.

1. Mudminnows avoid current (Meldrim 1968). It is not likely that mudminnows would have moved up the southerly flowing waters of the Puget Trough as ice receded 14,000 years ago. Many rapids were formed in this area (McPhail 1967). We have looked for Olympic mudminnows outside of the known range including areas north of the Nisqually River (Fig. 1) and have not found any.
2. Margaret Lake is found in the Cherry Creek drainage at a lower elevation than at least one of the sites mudminnows were collected in. Mudminnows often use lake environments and have been killed during past rotenone treatments. No Olympic mudminnows were observed during the 1962 rotenone treatment of Margaret Lake.
3. WDFW has over 100 elevation measurements of Olympic mudminnow collection sites. Only one site was located above 110 m (357 ft) at approximately 140 m (455 ft) (Fig. 2). The lower Cherry Creek site is 240 m (780 ft) and the Issaquah site is 135 m (439 ft).

Until proven otherwise, WDFW will assume that the Cherry Creek and Issaquah Creek populations were illegally introduced, likely from aquariums.

Historically, distribution of the Olympic mudminnow may have been more widespread. Fossils of the genus *Novumbra* were found in early-middle Oligocene Era deposits in the Columbia River drainage. The Olympic mudminnow may be remnants of these ancient fishes (Cavender 1969, McPhail and Lindsey 1986).

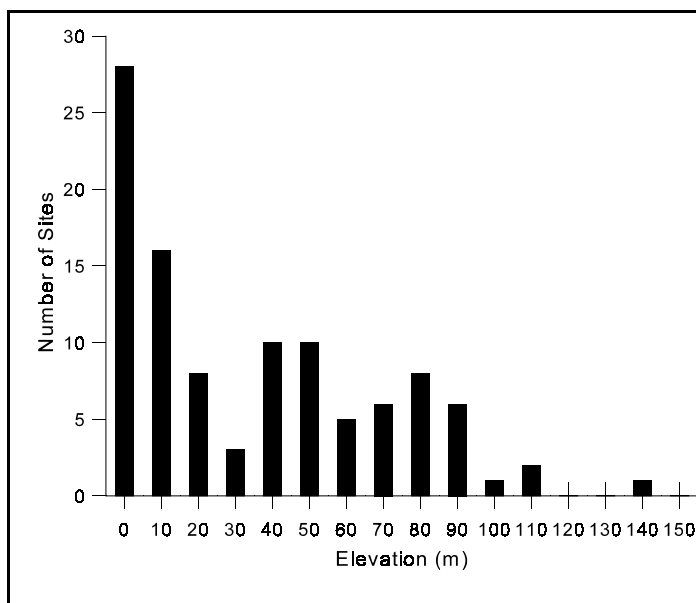


Figure 2. The number of mudminnow populations found at each elevation.

NATURAL HISTORY

Reproduction

Spawning takes place over an extended period. It begins in late November, subsides during the winter months, picks up again in March and ends by mid-June. The spawning peak takes place in April and May (Meldrim 1968, Hagen et al. 1972). Water temperatures during the breeding season ranged from 10-18 degrees C (50-64 F) (Meldrim 1968). The male's body color darkens and his vertical stripes turn iridescent blue, green or white. The edges of his dorsal and anal fins turn sky-blue to white. The coloration change usually takes place after egg deposition, but is also intense during courtship and fighting.

Hagen et al. (1972) describes breeding behavior in great detail. In summary, males set up territories approximately 111 cm (44 in) long by 43 cm (17 in) wide around clumps of vegetation. Territories are aggressively defended against intruders such as three-spine stickleback, salmon fry or other male Olympic mudminnows. Much time is spent patrolling. When a female mudminnow enters the territory the males perform a courtship display called a wigwag dance. After dancing and other courting displays, if the female is receptive the pair move into the vegetation to spawn. The pair vibrate parallel and close to each other, and with a sudden thrust against each other, one or two eggs are released. Females choose the site for egg deposition, usually nestled down in the vegetation, and may spawn repeatedly for more than an hour. Males have multiple matings over several weeks. Hagen et al. (1972) observed defense of territories for seven weeks but speculated it is probably longer.

Eggs are adhesive and are usually deposited near the bottom. No parental care of eggs or fry has been observed. In the laboratory, eggs hatched in nine days at 15-17 degrees C (59-63 F). Fry are light brown, seldom move, and adhere strongly to vegetation. Meldrim (1968) noted two pores on the side of larvae heads that extruded a sticky mucus allowing the small fish to stick to vegetation. Hagen et al. (1972) observed fry dispersal after about seven days in his laboratory study.

Mortality

Little is known about natural mortality of Olympic mudminnows. However, Beecher and Fernau (1983) did not find any mudminnows in sites containing exotic fish predators. It is not known if predation or competition was the reason for absence of mudminnows.

Food

Diet of the Olympic mudminnow is typical of a small carnivorous fish. Major prey groups in order of relative abundance, beginning with the most abundant, include Ostracoda, Isopoda, Oligochaeta, Mysidacea, Megaloptera, Mollusca, and Diptera. No differences were observed due to sex or maturity of the fish (Meldrim 1968).

Associated Fishes

Olympic mudminnow populations sampled in 1973 (Harris 1974) and 1993-1998 (WDFW surveys) were usually found with one to four other fish species (Fig. 3). Only one population, near Lake Ozette, had no other fish species present. Fourteen different fish species were associated with the Olympic mudminnow, but only three were common (Fig. 4). Reticulate sculpin (*Cottus perplexus*) and three-spine stickleback (*Gasterosteus aculeatus*), were the two most common fishes, both occurring with over 70 percent of sampled Olympic mudminnow populations. Coho salmon (*Oncorhynchus kisutch*) were the third most common fish (50 percent), but were never found alone with Olympic mudminnows. In their study of oxbow lakes, Beecher and Fernau (1983) never collected Olympic mudminnows when exotic fish species were present, but always found them co-existing with three-spine sticklebacks.

A comparison of catch-per-unit-effort (CPUE) of Olympic mudminnows versus number of other fish species present indicates that Olympic mudminnows do not compete well

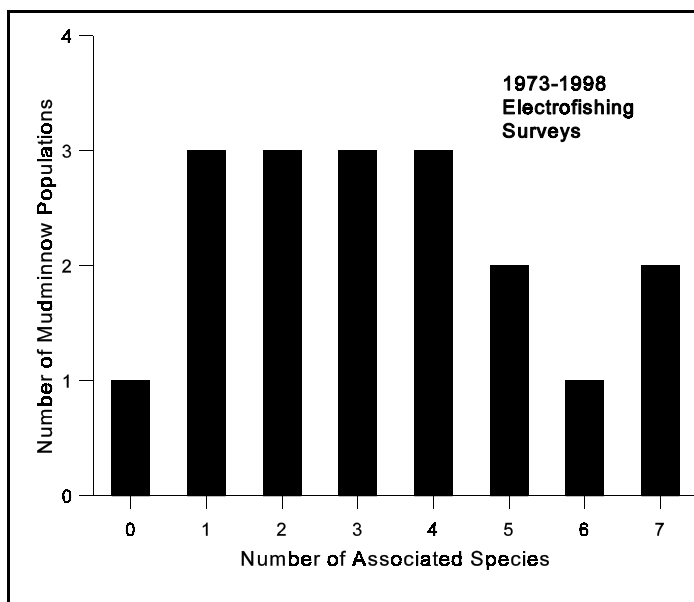


Figure 3. Number of other fish species associated with various Olympic mudminnow populations.

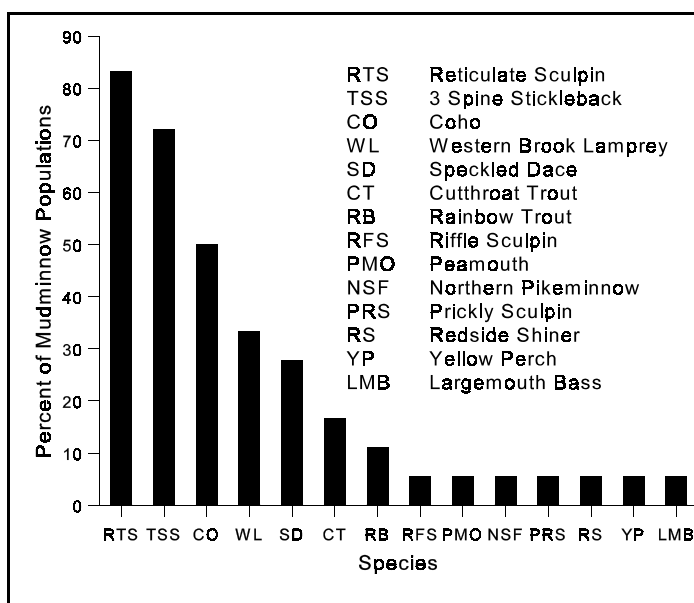


Figure 4. The percent of time each species was found with various Olympic mudminnow populations.

and/or are preyed upon by other fish species (Fig. 5). As the number of fish species increases, the CPUE of Olympic mudminnows declines. Beecher and Fernau's work (1983) suggests Olympic mudminnows are missing from oxbow lakes because of the presence of exotic fish species. WDFW's 1993-98 survey indicates that the presence of two or more native fish species may also inhibit Olympic mudminnow populations. Olympic mudminnows appear to be quite sensitive to competition/predation from exotic and native fish species.

HABITAT REQUIREMENTS

Olympic mudminnows are usually found in slow-moving streams, wetlands and ponds. Harris (1974) concluded three habitat characteristics appear to be required: several centimeters of soft mud bottom substrate, little to no water flow, and abundant aquatic vegetation. If any of these characteristics were missing, no mudminnows were found.

A site near Lake Ozette (Fig. 6) was dredged several days before we sampled it in 1995. All vegetation was removed in and around the site. Water flow was also increased. There were still mudminnows present when we sampled in 1995. However, in 1996 the site was still lacking vegetation and no mudminnows were present. As vegetation slowly returned over the years, number of mudminnows increased to pre-dredging levels. Olympic mudminnow can recover from dredging if the site is allowed to re-vegetate and they still have suitable access to the area.

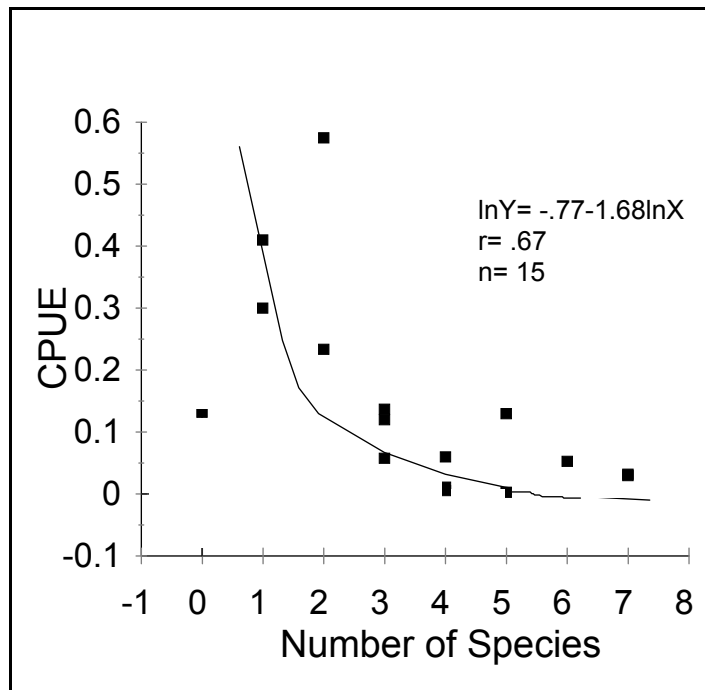


Figure 5. Number of other fish species associated with Olympic mudminnows versus mudminnow catch per electrofishing second (CPUE).

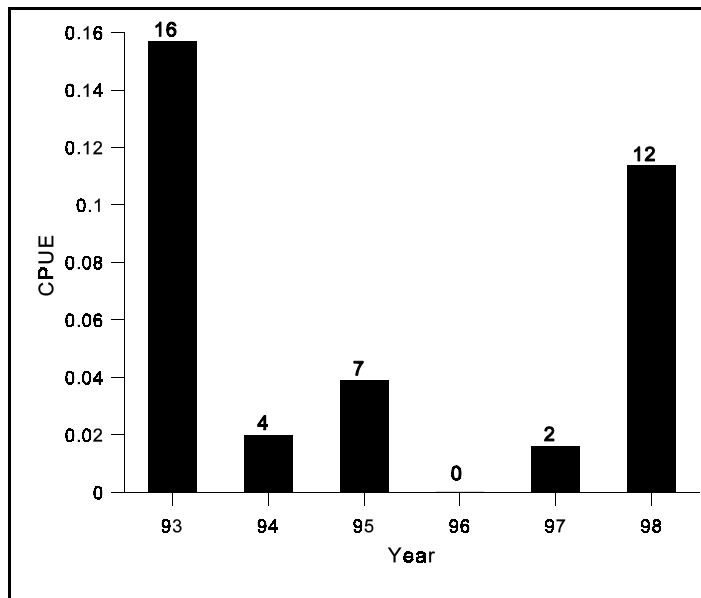


Figure 6. Catch of Olympic mudminnow per electrofishing second (CPUE). Site was dredged days before sampling in 1995.

Meldrim (1968) investigated other habitat variables influencing the Olympic mudminnow. A restricted tolerance range of water current and salinity was exhibited, but a wide tolerance range for temperature and oxygen was observed. In habitats with suitable current and salinity, the amount of light was the most important factor, followed by substrate type, plants, and temperature. These variables are important all year, but Meldrim observed that interactions among them during the summer was even more significant. In summer, the most preferred area was cool water with mud substrate and some form of shading.

Low tolerance to water current has restricted Olympic mudminnows to lowlands (Fig. 2). Generally, as elevation increases so do slope and water current. Over 60 percent of mudminnow collection sites (105 sites) are under 50 m (162 ft). Less than four percent are above 100 m (325 ft).

POPULATION STATUS

Past

Harris (1974) completed the first detailed search for Olympic mudminnows in 1973 within the then described range (McPhail 1967, Meldrim 1968). He electrofished 108 different sites in mostly wetland type habitats. He found mudminnows in 25 of those sites and documented catch per unit of effort (CPUE) and habitat descriptions. Population abundance data collected in only one year is not adequate for determining past status; however, it does serve as a relative benchmark. Harris' electrofishing data are included in the trend data described in the next section of the report. There were more wetland habitats and therefore more mudminnow populations before development began (see the "Habitat Status" section of this report). However, it is not known to what degree.

Present

WDFW began investigations into the status of the Olympic mudminnow in 1993. We set out to sample as many of Harris' sites, where mudminnows were collected, that we could find. Each site was to be monitored for a five or six-year period. We were not able to find all 25 sites where Harris found mudminnows, but we believe we found most. We collected relative population abundance data on 16 of those sites. Appendix A shows the location of each of Harris' study sites that we sampled. One of the sites that Harris found mudminnows in is no longer a wetland. We do not know if the wetland filled in naturally or through human-caused activities.

We sampled the sites in the same manner as Harris. In addition, we weighed and measured Olympic mudminnows to monitor trends in condition factor, a relationship between length and weight that gives an indication of the health of an individual fish. Appendix B (Fig. 8-23) summarizes population trends while Appendix C (Fig. 24-26) summarizes condition factor trends. Condition factors of fish below 40 mm (1.57 in) are variable, while they appear stable

for larger sized fish (Appendix D). Additionally, fish under 40 mm (1.57 in) in length were not usually well represented in samples because of difficulty of capture. It was therefore decided to monitor condition factor of the more numerous and larger sized fish.

Harris' 1973 population CPUE's are included in the population trend figures in Appendix B. In many cases Harris' CPUE's are considerably higher than any CPUE we documented in the 1993 to 1998 time period. We don't know why. Harris stated that 1973 was a drought year. Perhaps the fish were concentrated and easily captured during electrofishing surveys. It is best to proceed conservatively in these situations. The important factor to consider is that Olympic mudminnows are still present in all but one of the sites that Harris sampled 25 years ago. Unfortunately, Colin Harris passed away before we began this study and we were not able to interview him.

Appendix B details observations on population trends for each site. However, some general observations are presented here. Twelve of the 16 sites we monitored from 1993 to 1998 did not show any apparent downward trends in population abundance. Condition factors were also stable (Appendix C). Two populations showed downward trends from 1993 to 1997, but both rebounded in 1998. One population (site 108) showed a decline in 1996 and again in 1997. We were not able to sample this site in 1998 because of extremely low water conditions. Site 108 near Copalis Beach, gives cause for concern. Site 77 near the Humptulips River, also gives cause for concern. After apparently normal population fluctuation through 1996, no mudminnows were found in either 1997 or 1998.

Of the 16 populations monitored from 1993 to 1998, 14 or 87.5 percent appear to be stable and in no immediate danger of extinction. Two are at some level of risk. According to WDFW records there are 112 documented sites containing mudminnows. There are undoubtedly more undiscovered populations within the range of the species. We do not know the population status of sites not sampled.

Future

The future of the Olympic mudminnow is completely dependant upon our ability to maintain the quality and amount of lowland wetlands within its range. Even if all populations are healthy, the very restricted distribution poses concern for the future. Local disturbances may have profound effects on its persistence.

HABITAT STATUS

Past

Olympic mudminnows live primarily in wetland habitats. Estimates of historical (pre-settlement) wetland acreage in Washington range from .47 to .61 million ha (1.17 to 1.53 million ac) (D.D. Peters 1990, Washington State Department of Ecology 1992). The U.S. Fish and Wildlife Service 1988 National Wetlands Inventory estimates that only 375,200 ha (938,000 ac) remain,

representing a loss of 20 to 39 percent (D.D. Peters 1990). Other estimates of wetland loss range from 33 to 50 percent (Canning and Stevens 1989). Between 1900 and 1956, wetland losses for areas of south Thurston County were estimated at 55 percent (Boule et al. 1983). This area lies within the range of the Olympic mudminnow. Many of the remaining wetlands have varying degrees of degradation (Washington Department of Ecology 1992). There are no figures available for wetland loss on the Olympic Peninsula. However, the Olympic mudminnow's distribution is in the lowlands where land development/utilization has mostly occurred. Major causes of historical wetland loss were agricultural and industrial expansion and port sitings (Lane and Taylor 1996).

Present

Wetland loss and degradation has not stopped. Washington Department of Ecology (1992) estimates a continued loss of 280 to 800 ha (700 to 2000 ac) of wetland each year. Major causes have shifted to urbanization, forestry and agricultural practices and invasion by exotic plants and animals (Canning and Stevens 1989, Washington Department of Ecology 1992, Lane and Taylor 1996).

Future

Survival of the Olympic mudminnow is completely dependent upon our ability to stop loss and degradation of wetland habitat.

CONSERVATION STATUS

Legal Status

The Olympic mudminnow is a Washington State Candidate species.

Management Activities

Olympic mudminnows are classified as a Priority Species under WDFW Priority Species and Habitat Program (PHS). This designation represents a proactive approach to help mitigate the increasing pressures of human population growth on the state's fish and wildlife species and habitat. Locational information and management recommendations provided by PHS aide local governments and others in guiding growth in a manner which will best preserve and protect wildlife species and habitat. Whenever a project that affects fish and wildlife (logging, construction) is reviewed, PHS species and habitats in the project area are identified. Management recommendations are then made to protect PHS species and habitat. Also, when a project will use, divert, obstruct or change the natural flow or bed of any water a hydraulic project approval (HPA) must be obtained from WDFW. Recommendations in the HPA for the protection of aquatic habitat and species must be closely followed.

In 1989 and 1990, Governor Booth Gardner issued two executive orders (EO 89-10, EO 90-04) aimed at protecting wetlands. Their focus was directional. It required all state agencies to use their existing authority to the maximum extent possible to achieve the interim goal of "no overall net loss of wetlands" and the long term goal "to increase the quantity and quality" of wetlands. The executive orders also assigned specific tasks to agencies to enable them to better protect wetlands.

Two federal programs which provide incentives to protect wetlands are The Wetland Reserves Program (1990 Food, Agriculture, Conservation and Trade Act) and the 1986 Emergency Wetlands Resources Act.

FACTORS AFFECTING CONTINUED EXISTENCE

Adequacy of Existing Regulatory Mechanisms

There are no regulatory mechanisms in place to control harvest of Olympic mudminnows under the provisions of the Wildlife Code of Washington. The species is unclassified and can be legally taken at any time without a permit. However, Olympic mudminnows have no sport or commercial value. Therefore, there are no harvest issues at this time. Because they are a PHS species, their needs are taken into account when a proposed project may impact its habitat. Recommendations for protection are often simply advisory. These measures offer minimal protection for Olympic mudminnows. However, when a project will use, divert, obstruct, or change the natural flow or bed of any water a hydraulic permit approval (HPA) must be obtained from WDFW. Recommendations in the HPA for the protection of aquatic habitat and species must be closely followed. Forest practices may be altered to protect salmon and trout through the Washington Forest Practices Act. Olympic mudminnows may receive some indirect protection through this Act and other salmonid protection plans.

There is a myriad of wetland or wetland-associated regulations ranging from local zoning ordinances to the federal Clean Water Act. Washington State's 1990 Growth Management Act (GMA; RCW 36.70A) and its amendments has probably been one of the more instrumental tools in wetland preservation. In developing their growth management plans, some local and county governments have adopted more restrictive wetland regulations and included wetlands which are not covered under state or federal regulations. However, local regulations created under GMA and their implementation varies widely across the state. Other major state regulations which affect wetlands are the Shoreline Management Act (RCW 90.58) and the Water Pollution Control Act (RCW 90.48.020). Major federal acts include the 1972 Clean Water Act (Section 401 and 404) and the 1985 Food Security Act. There are many more state and federal regulations not mentioned here which touch on wetland protection. Despite all the wetland regulatory functions of various governmental agencies, holes in the regulations persist and wetlands are still being lost.

Present and Threatened Habitat Loss

Any loss of wetland habitat within the range of the Olympic mudminnow is an immediate threat. Alteration of wetlands that eliminate mud substrate, aquatic vegetation or increase water flow are threats. These measures may be used to provide salmon access to some areas and could conflict with Olympic mudminnow habitat needs. Improper use of agricultural, silvacultural and urban chemicals are a threat, as is accelerated filling of wetlands through logging, agriculture, road building or development within the watershed.

CONCLUSIONS AND RECOMMENDATIONS

Olympic mudminnows are found only in Washington State in a very small lowland portion of western Washington. Wetland habitat, the mudminnow's primary habitat, is still being lost every year. Because of these losses and its very small range, it is vulnerable and likely to become threatened or endangered in a significant portion of its range without cooperative management. The Department therefore recommends that the Olympic mudminnow be designated as a sensitive species in Washington.

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Appendix A. Location of study sites.

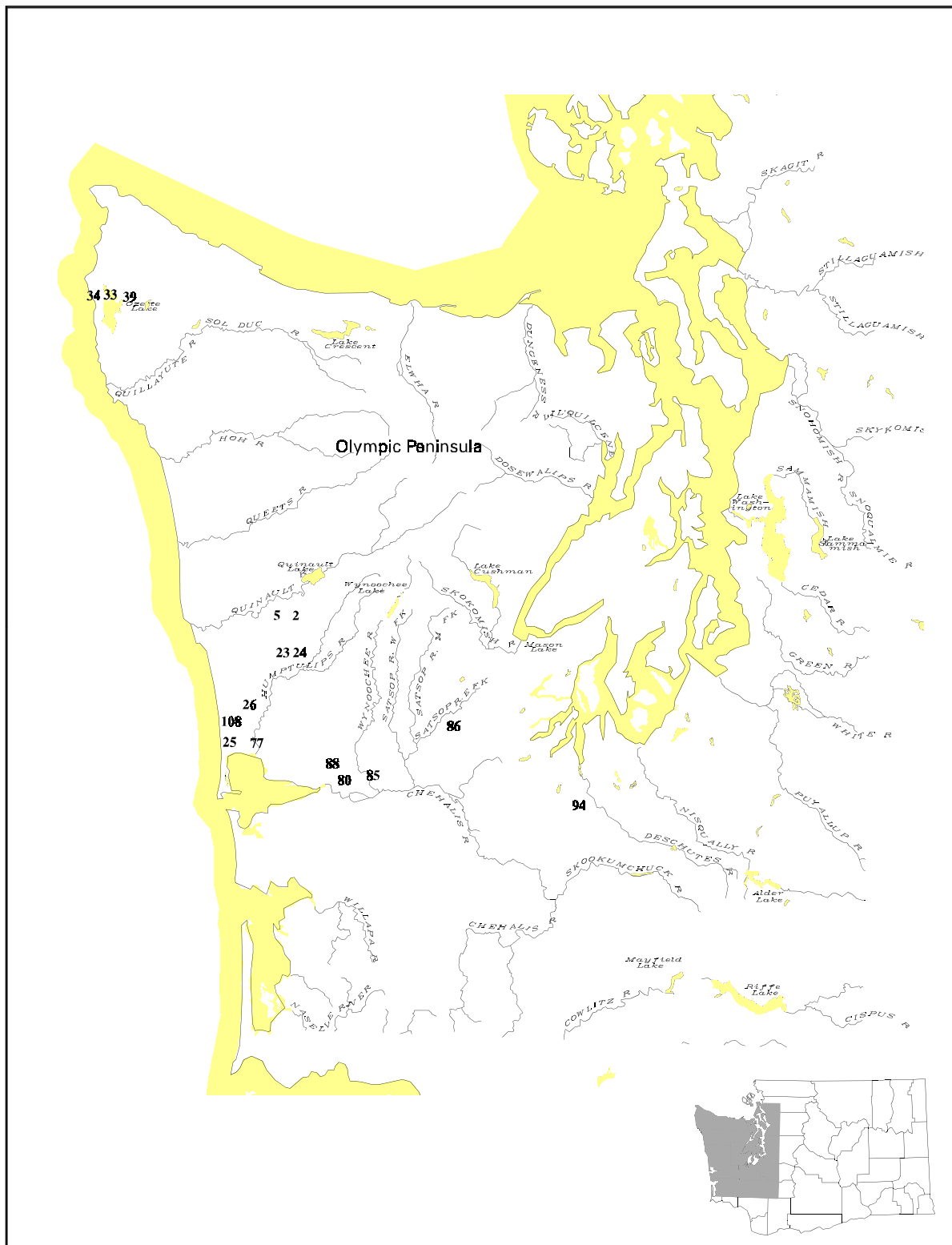


Figure 7. Location of Olympic mudminnow study sites.

Appendix B. Population trend data.

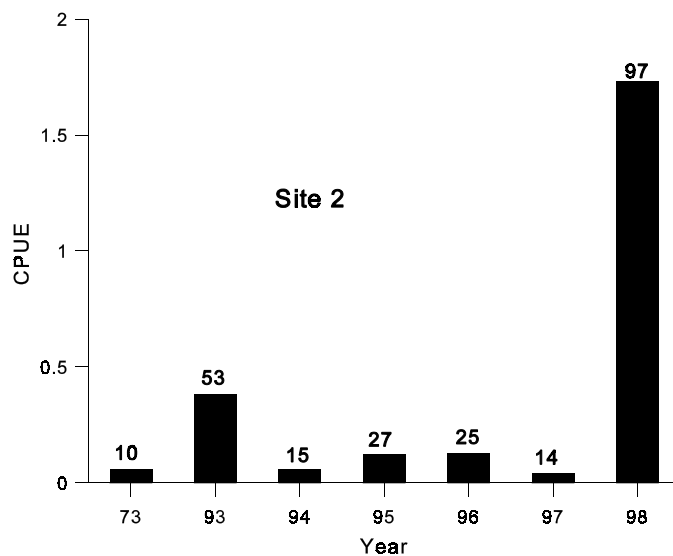


Figure 8. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 2. Numbers above bars are number captured.

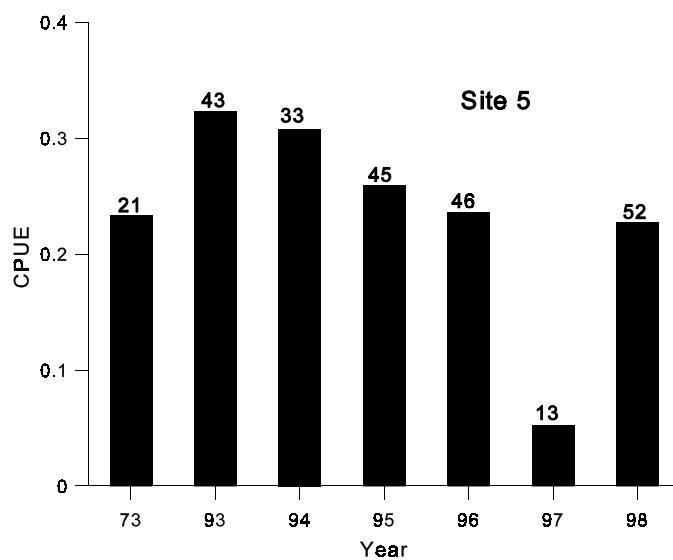


Figure 9. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 5. Numbers above bars are number captured.

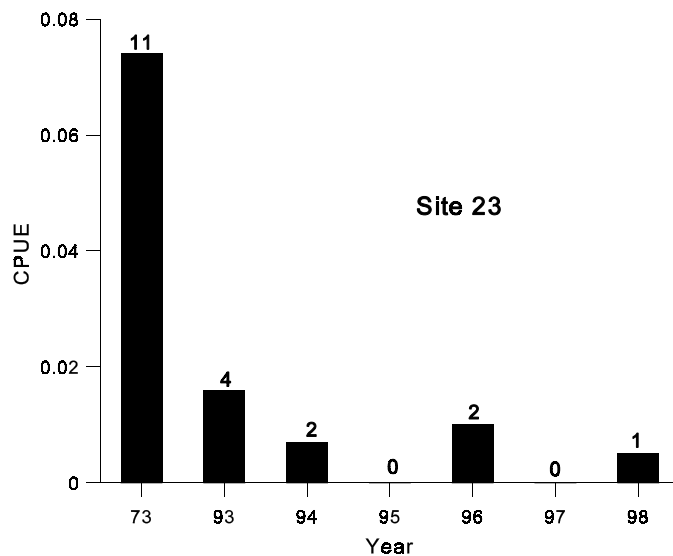


Figure 10. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 23. Numbers above bars are number captured.

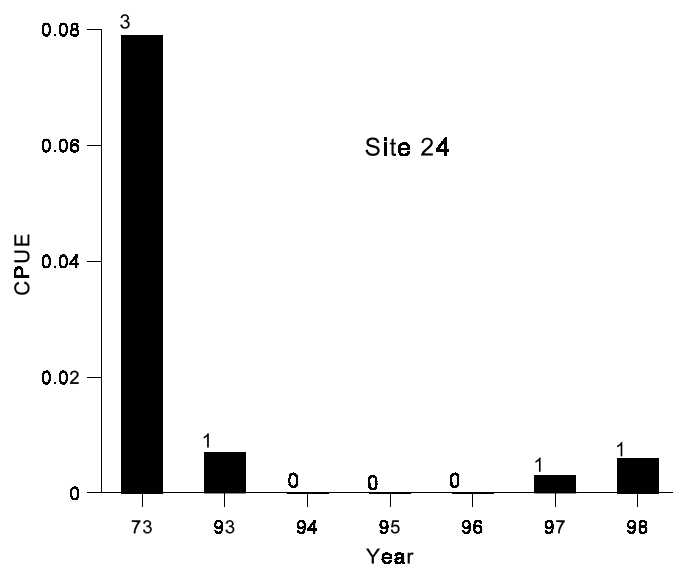


Figure 11. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 24. Numbers above bars are number captured.

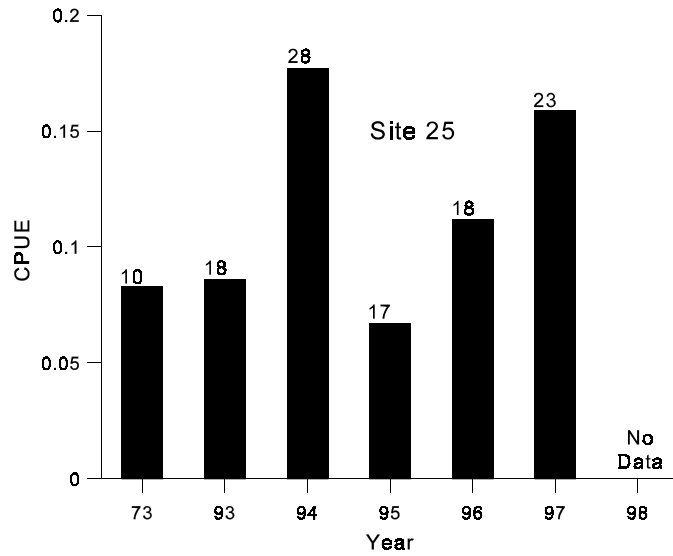


Figure 12. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 25. Numbers above the bars are number captured.

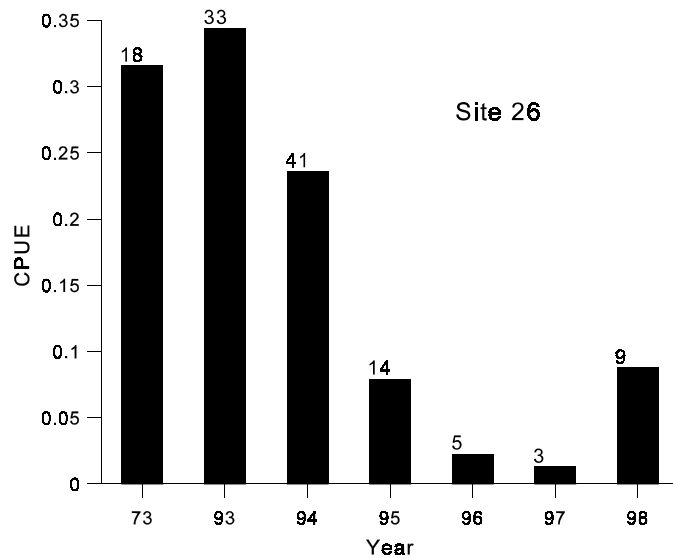


Figure 13. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 26. Numbers above the bars are number captured.

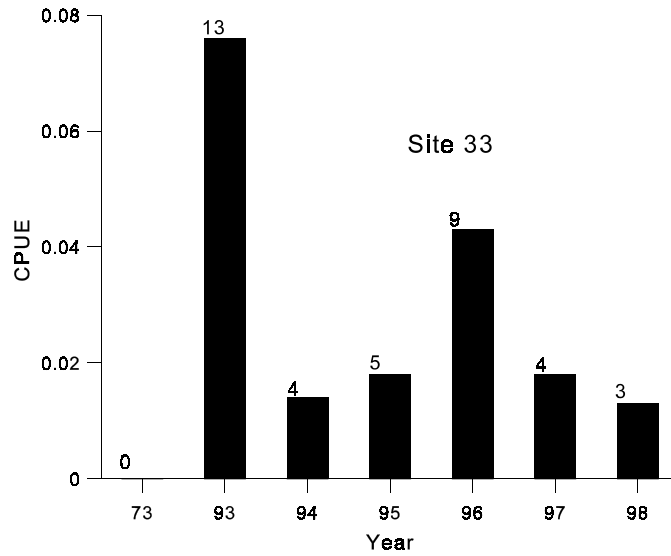


Figure 14. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 33. Numbers above bars are number captured.

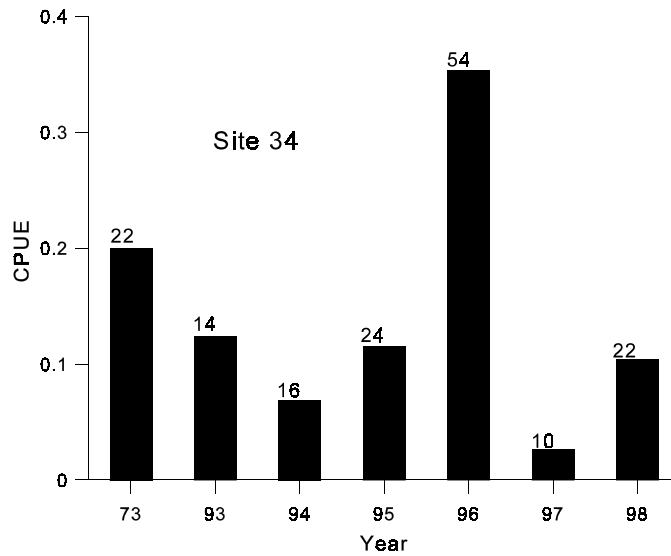


Figure 15. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 34. Numbers above bars are number captured.

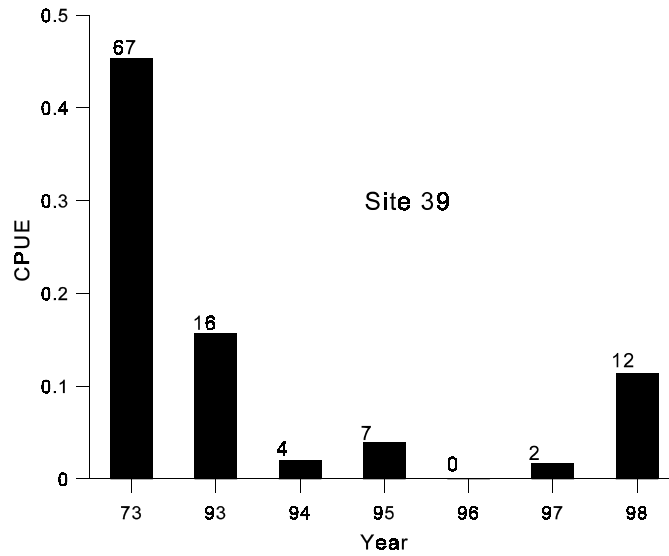


Figure 16. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 39. Numbers above bars are number captured.

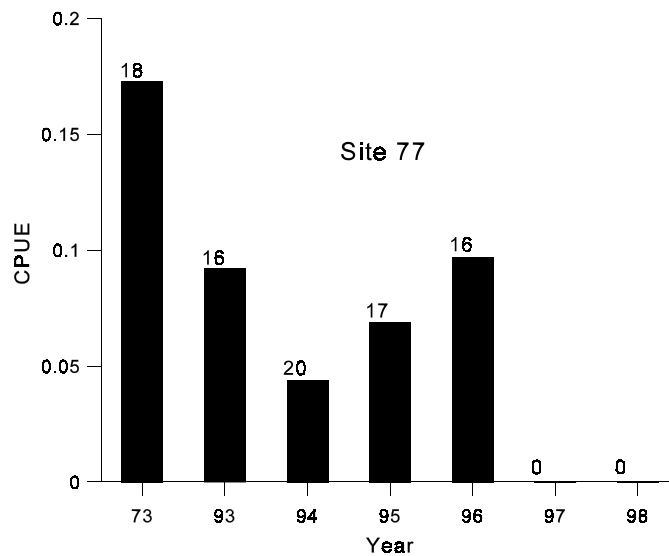


Figure 17. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 77. Numbers above bars are number captured.

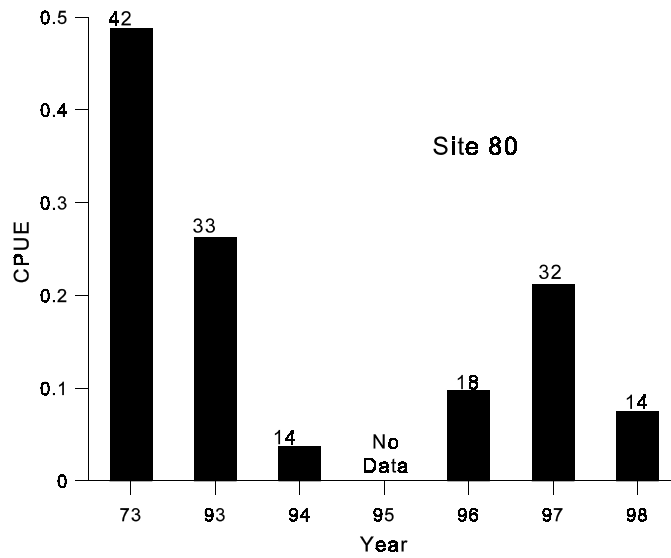


Figure 18. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 80. Numbers above bars are number captured.

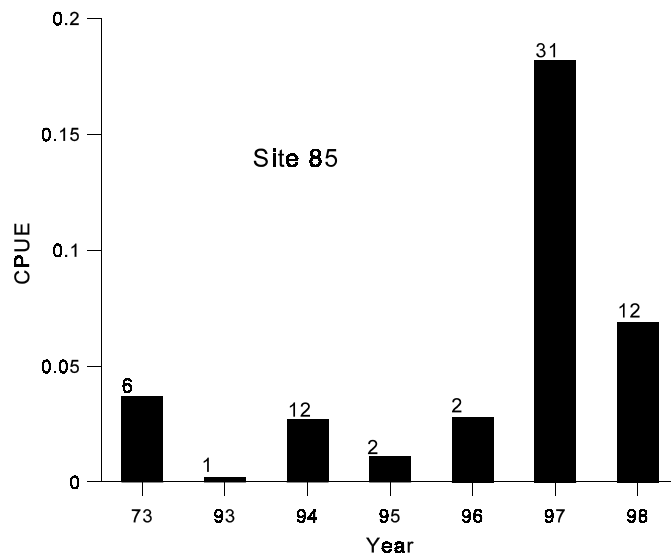


Figure 19. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 85. Numbers above the bars are number captured.

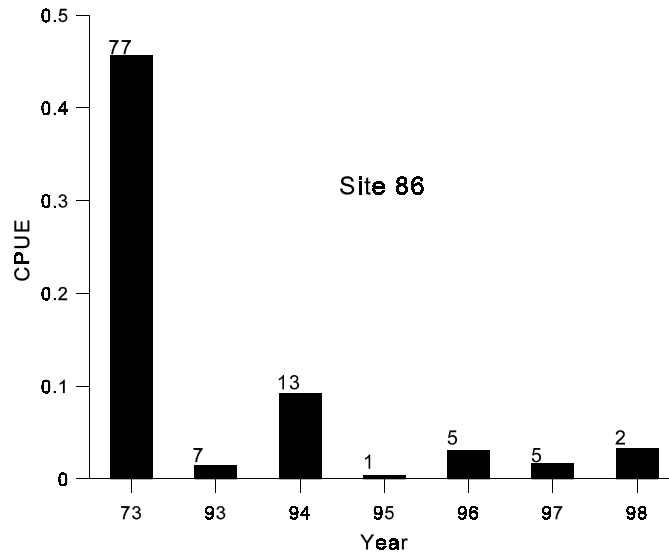


Figure 20. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 86. Numbers above bars are number captured.

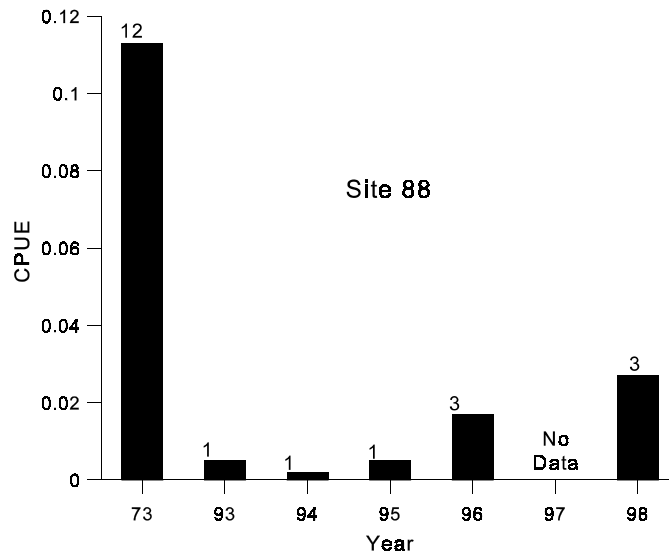


Figure 21. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 88. Numbers above bars are number captured.

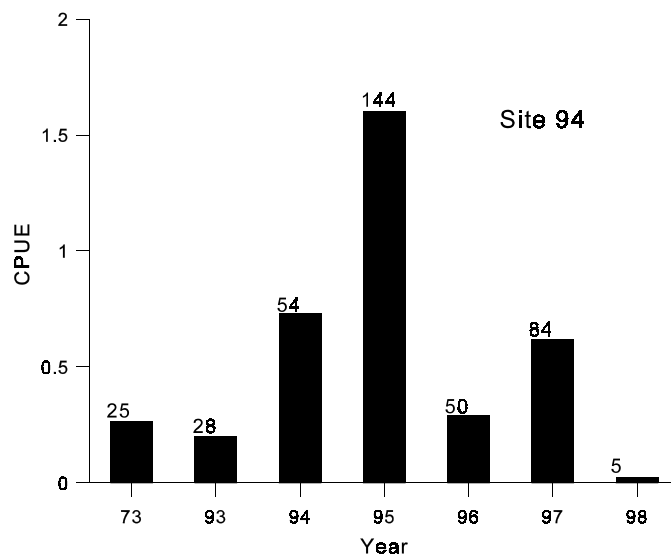


Figure 22. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 94. Numbers above bars are number captured.

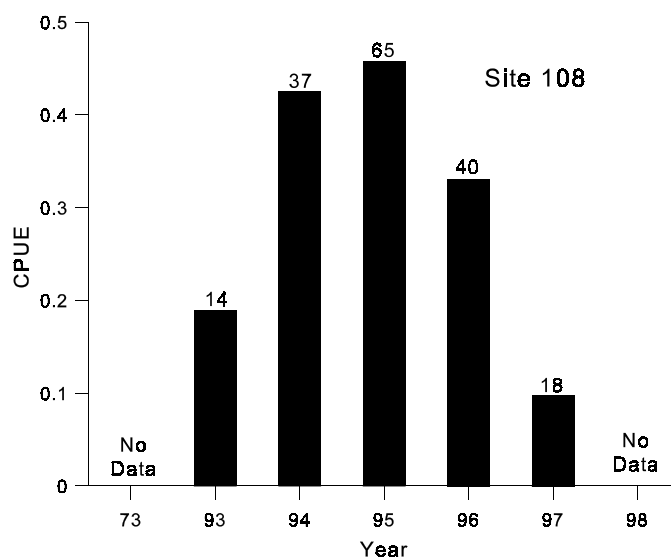


Figure 23. Catch of Olympic mudminnow per electrofishing second (CPUE) for Site 108. Numbers above bars are number captured.

Appendix C. Condition factor trend data.

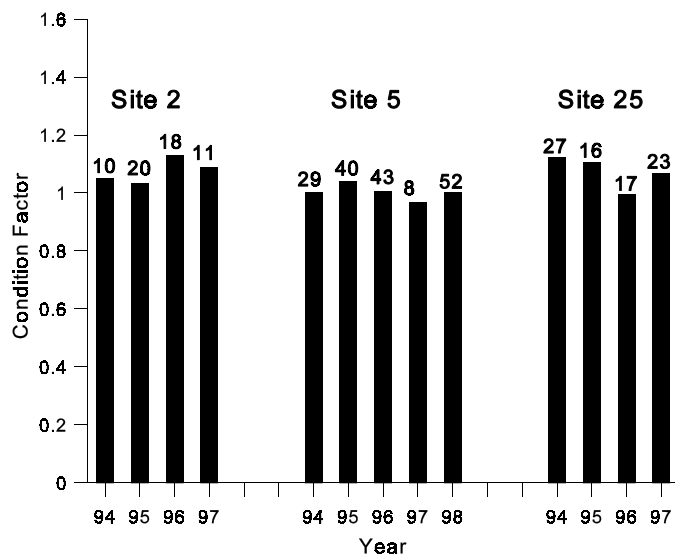


Figure 24. Average condition factor for Olympic mudminnow over 39 mm for Sites 2, 5, and 25. Numbers above bars are sample size.

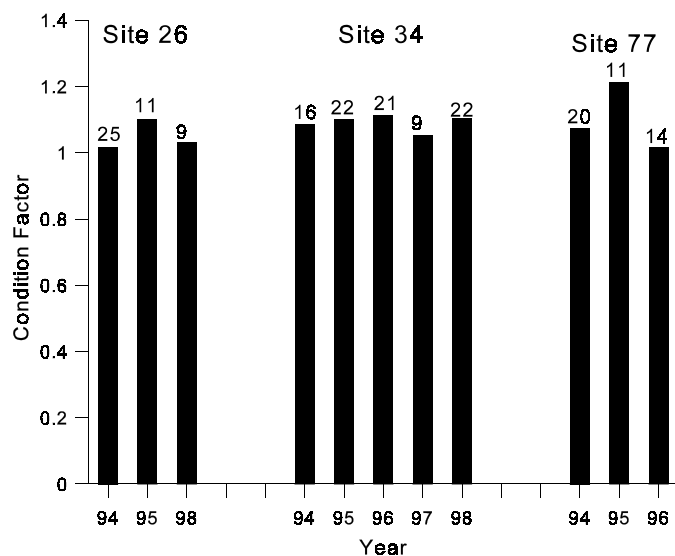


Figure 25. Average condition factor for Olympic mudminnow over 39 mm from Sites 26, 34, and 77. Numbers above bars are sample size.

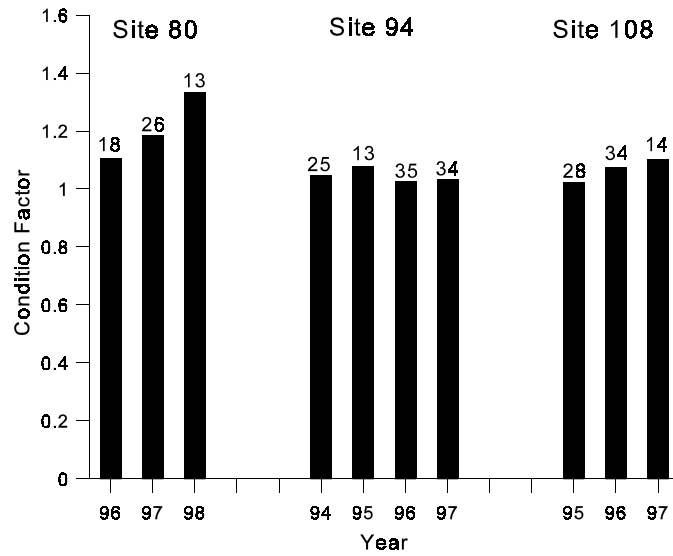


Figure 26. Average condition factor for Olympic mudminnow over 39 mm from Sites 80, 94, and 108. Numbers above bars are sample size.

Appendix D. Size, condition factor relationship.

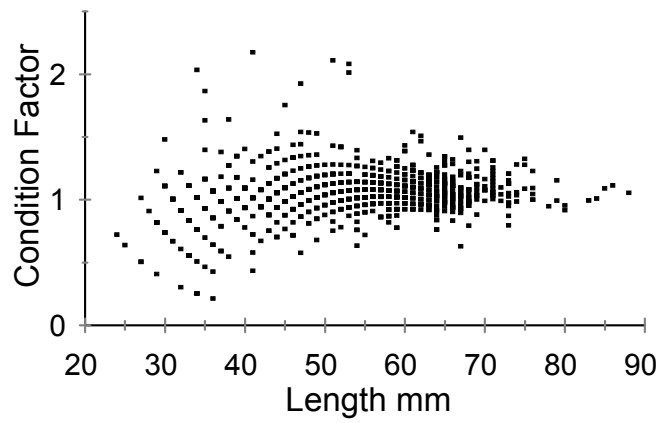


Figure 27. Olympic mudminnow condition factors for all sites, all years and all fish.

Appendix E. Washington Administrative Codes.

WAC 232-12-011 Wildlife classified as protected shall not be hunted or fished.

Protected wildlife are designated into three subcategories: Threatened, sensitive, and other.

(1) Threatened species are any wildlife species native to the state of Washington that are likely to become endangered within the foreseeable future throughout a significant portion of their range within the state without cooperative management or removal of threats. Protected wildlife designated as threatened include:

Common Name	Scientific Name
western gray squirrel	<i>Sciurus griseus</i>
Steller (northern) sea lion	<i>Eumetopias jubatus</i>
North American lynx	<i>Lynx canadensis</i>
Aleutian Canada goose	<i>Branta Canadensis leucopareia</i>
bald eagle	<i>Haliaeetus leucocephalus</i>
ferruginous hawk	<i>Buteo regalis</i>
marbled murrelet	<i>Brachyramphus marmoratus</i>
green sea turtle	<i>Chelonia mydas</i>
loggerhead sea turtle	<i>Caretta caretta</i>
sage grouse	<i>Centrocercus urophasianus</i>
sharp-tailed grouse	<i>Phasianus columbianus</i>

(2) Sensitive species are any wildlife species native to the state of Washington that are vulnerable or declining and are likely to become endangered or threatened in a significant portion of their range within the state without cooperative management or removal of threats. Protected wildlife designated as sensitive include:

Common Name	Scientific Name
Gray whale	<i>Eschrichtius gibbosus</i>
Larch Mountain salamander	<i>Plethodon larselli</i>
Pygmy whitefish	<i>Prosopium coulteri</i>
Margined sculpin	<i>Cottus marginatus</i>

(3) Other protected wildlife include:

Common Name	Scientific Name
cony or pika	<i>Ochotona princeps</i>
least chipmunk	<i>Tamias minimus</i>
yellow-pine chipmunk	<i>Tamias amoenus</i>
Townsend's chipmunk	<i>Tamias townsendii</i>
red-tailed chipmunk	<i>Tamias ruficaudus</i>
hoary marmot	<i>Marmota caligata</i>
Olympic marmot	<i>Marmota olympus</i>
Cascade golden-mantled ground squirrel	<i>Spermophilus saturatus</i>
golden-mantled ground squirrel	<i>Spermophilus lateralis</i>
Washington ground squirrel	<i>Spermophilus washingtoni</i>
red squirrel	<i>Tamiasciurus hudsonicus</i>
Douglas squirrel	<i>Tamiasciurus douglasii</i>
northern flying squirrel	<i>Glaucomys sabrinus</i>
wolverine	<i>Gulo gulo</i>
painted turtle	<i>Chrysemys picta</i>
California mountain kingsnake	<i>Lampropeltis zonata</i> ;

All birds not classified as game birds, predatory birds or endangered species, or designated as threatened species or sensitive species; all bats, except when found in or immediately adjacent to a dwelling or other occupied building; all wildlife within Titlow Beach Marine Preserve Area and the conservation areas defined in chapter 220-16 WAC; mammals of the order *Cetacea*, including whales, porpoises, and mammals of the order *Pinnipedia* not otherwise classified as endangered species, or designated as threatened species or sensitive species. This section shall not apply to hair seals and sea lions which are threatening to damage or are damaging commercial fishing gear being utilized in a lawful manner or when said mammals are damaging or threatening to damage commercial fish being lawfully taken with commercial gear.

[Statutory Authority: RCW 77.12.020. 98-23-013 (Order 98-232), § 232-12-011, filed 11/6/98, effective 12/7/98. Statutory Authority: RCW 77.12.040. 98-10-021 (Order 98-71), § 232-12-011, filed 4/22/98, effective 5/23/98. Statutory Authority: RCW 77.12.040 and 75.08.080. 98-06-031, § 232-12-011, filed 2/26/98, effective 5/1/98. Statutory Authority: RCW 77.12.020. 97-18-019 (Order 97-167), § 232-12-011, filed 8/25/97, effective 9/25/97. Statutory Authority: RCW 77.12.040, 77.12.020, 77.12.030 and 77.32.220. 97-12-048, § 232-12-011, filed 6/2/97, effective 7/3/97. Statutory Authority: RCW 77.12.020. 93-21-027 (Order 615), § 232-12-011, filed 10/14/93, effective 11/14/93; 90-11-065 (Order 441), § 232-12-011, filed 5/15/90, effective 6/15/90. Statutory Authority: RCW 77.12.040. 89-11-061 (Order 392), § 232-12-011, filed 5/18/89; 82-19-026 (Order 192), § 232-12-011, filed 9/9/82; 81-22-002 (Order 174), § 232-12-011, filed 10/22/81; 81-12-029 (Order 165), § 232-12-011, filed 6/1/81.]

WAC 232-12-014 Wildlife classified as endangered species. Endangered species include:

Common Name	Scientific Name
pygmy rabbit	<i>Brachylagus idahoensis</i>
fisher	<i>Martes pennanti</i>
gray wolf	<i>Canis lupus</i>
grizzly bear	<i>Ursus arctos</i>
sea otter	<i>Enhydra lutris</i>
sei whale	<i>Balaenoptera borealis</i>
fin whale	<i>Balaenoptera physalus</i>
blue whale	<i>Balaenoptera musculus</i>
humpback whale	<i>Megaptera novaeangliae</i>
black right whale	<i>Balaena glacialis</i>
sperm whale	<i>Physeter macrocephalus</i>
Columbian white-tailed deer	<i>Odocoileus virginianus leucurus</i>
woodland caribou	<i>Rangifer tarandus caribou</i>
American white pelican	<i>Pelecanus erythrorhynchos</i>
brown pelican	<i>Pelecanus occidentalis</i>
peregrine falcon	<i>Falco peregrinus</i>
sandhill crane	<i>Grus canadensis</i>
snowy plover	<i>charadrius alexandrinus</i>
upland sandpiper	<i>Bartramia longicauda</i>
spotted owl	<i>Strix occidentalis</i>
western pond turtle	<i>Clemmys marmorata</i>
leatherback sea turtle	<i>Dermochelys coriacea</i>
Oregon silverspot butterfly	<i>Speyeria zerene hippolyta</i>
Oregon spotted frog	<i>Rana pretiosa</i>

[Statutory Authority: RCW 77.12.020. 98-23-013 (Order 98-232), § 232-12-014, filed 11/6/98, effective 12/7/98; 97-18-019 (Order 97-167), § 232-12-014, filed 8/25/97, effective 9/25/97; 93-21-026 (Order 616), § 232-12-014, filed 10/14/93, effective 11/14/93. Statutory Authority: RCW 77.12.020(6). 88-05-032 (Order 305), § 232-12-014, filed 2/12/88. Statutory Authority: RCW 77.12.040. 82-19-026 (Order 192), § 232-12-014, filed 9/9/82; 81-22-002 (Order 174), § 232-12-014, filed 10/22/81; 81-12-029 (Order 165), § 232-12-014, filed 6/1/81.]

WAC 232-12-297 Endangered, threatened, and sensitive wildlife species classification.

Purpose

- 1.1 The purpose of this rule is to identify and classify native wildlife species that have need of protection and/or management to ensure their survival as free-ranging populations in Washington and to define the process by which listing, management, recovery, and delisting of a species can be achieved. These rules are established to ensure that consistent procedures and criteria are followed when classifying wildlife as endangered, or the protected wildlife subcategories threatened or sensitive.

Definitions

For purposes of this rule, the following definitions apply:

- 2.1 "Classify" and all derivatives means to list or delist wildlife species to or from endangered, or to or from the protected wildlife subcategories threatened or sensitive.
- 2.2 "List" and all derivatives means to change the classification status of a wildlife species to endangered, threatened, or sensitive.
- 2.3 "Delist" and its derivatives means to change the classification of endangered, threatened, or sensitive species to a classification other than endangered, threatened, or sensitive.
- 2.4 "Endangered" means any wildlife species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state.
- 2.5 "Threatened" means any wildlife species native to the state of Washington that is likely to become an endangered species within the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats.
- 2.6 "Sensitive" means any wildlife species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened in a significant portion of its range within the state without cooperative management or removal of threats.
- 2.7 "Species" means any group of animals classified as a species or subspecies as commonly accepted by the scientific community.
- 2.8 "Native" means any wildlife species naturally occurring in Washington for purposes of breeding, resting, or foraging, excluding introduced species not found historically in this state.
- 2.9 "Significant portion of its range" means that portion of a species' range likely to be essential to the long term survival of the population in Washington.

Listing criteria

- 3.1 The commission shall list a wildlife species as endangered, threatened, or sensitive solely on the basis of the biological status of the species being considered, based on the preponderance of scientific data available, except as noted in section 3.4.
- 3.2 If a species is listed as endangered or threatened under the federal Endangered Species Act, the agency will recommend to the commission that it be listed as endangered or threatened as specified in section 9.1. If listed, the agency will proceed with development of a recovery plan pursuant to section 11.1.
- 3.3 Species may be listed as endangered, threatened, or sensitive only when populations are in danger of failing, declining, or are vulnerable, due to factors including but not restricted to limited numbers, disease, predation, exploitation, or habitat loss or change, pursuant to section 7.1.

- 3.4 Where a species of the class Insecta, based on substantial evidence, is determined to present an unreasonable risk to public health, the commission may make the determination that the species need not be listed as endangered, threatened, or sensitive.

Delisting criteria

- 4.1 The commission shall delist a wildlife species from endangered, threatened, or sensitive solely on the basis of the biological status of the species being considered, based on the preponderance of scientific data available.
- 4.2 A species may be delisted from endangered, threatened, or sensitive only when populations are no longer in danger of failing, declining, are no longer vulnerable, pursuant to section 3.3, or meet recovery plan goals, and when it no longer meets the definitions in sections 2.4, 2.5, or 2.6.

Initiation of listing process

- 5.1 Any one of the following events may initiate the listing process.
- 5.1.1 The agency determines that a species population may be in danger of failing, declining, or vulnerable, pursuant to section 3.3.
 - 5.1.2 A petition is received at the agency from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data which shows that the species may be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the classification process.
 - 5.1.3 An emergency, as defined by the Administrative Procedure Act, chapter 34.05 RCW. The listing of any species previously classified under emergency rule shall be governed by the provisions of this section.
 - 5.1.4 The commission requests the agency review a species of concern.
- 5.2 Upon initiation of the listing process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department, announcing the initiation of the classification process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

Initiation of delisting process

- 6.1 Any one of the following events may initiate the delisting process:
- 6.1.1 The agency determines that a species population may no longer be in danger of failing, declining, or vulnerable, pursuant to section 3.3.
 - 6.1.2 The agency receives a petition from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data which shows that the species may no longer be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the delisting process.
 - 6.1.3 The commission requests the agency review a species of concern.
- 6.2 Upon initiation of the delisting process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department, announcing the initiation of the delisting process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

Species status review and agency recommendations

- 7.1 Except in an emergency under 5.1.3 above, prior to making a classification recommendation to the commission, the agency shall prepare a preliminary species status report. The report will include a review of information relevant to the species'

status in Washington and address factors affecting its status, including those given under section 3.3. The status report shall be reviewed by the public and scientific community. The status report will include, but not be limited to an analysis of:

- 7.1.1 Historic, current, and future species population trends
 - 7.1.2 Natural history, including ecological relationships (e.g. food habits, home range, habitat selection patterns).
 - 7.1.3 Historic and current habitat trends.
 - 7.1.4 Population demographics (e.g. survival and mortality rates, reproductive success) and their relationship to long term sustainability.
 - 7.1.5 Historic and current species management activities.
- 7.2 Except in an emergency under 5.1.3 above, the agency shall prepare recommendations for species classification, based upon scientific data contained in the status report. Documents shall be prepared to determine the environmental consequences of adopting the recommendations pursuant to requirements of the State Environmental Policy Act (SEPA).
- 7.3 For the purpose of delisting, the status report will include a review of recovery plan goals.

Public review

- 8.1 Except in an emergency under 5.1.3 above, prior to making a recommendation to the commission, the agency shall provide an opportunity for interested parties to submit new scientific data relevant to the status report, classification recommendation, and any SEPA findings.
- 8.1.1 The agency shall allow at least 90 days for public comment.
 - 8.1.2 The agency will hold at least one Eastern Washington and one Western Washington public meeting during the public review period.

Final recommendations and commission action

- 9.1 After the close of the public comment period, the agency shall complete a final status report and classification recommendation. SEPA documents will be prepared, as necessary, for the final agency recommendation for classification. The classification recommendation will be presented to the commission for action. The final species status report, agency classification recommendation, and SEPA documents will be made available to the public at least 30 days prior to the commission meeting.
- 9.2 Notice of the proposed commission action will be published at least 30 days prior to the commission meeting.

Periodic species status review

- 10.1 The agency shall conduct a review of each endangered, threatened, or sensitive wildlife species at least every five years after the date of its listing. This review shall include an update of the species status report to determine whether the status of the species warrants its current listing status or deserves reclassification.
- 10.1.1 The agency shall notify any parties who have expressed their interest to the department of the periodic status review. This notice shall occur at least one year prior to end of the five year period required by section 10.1.
- 10.2 The status of all delisted species shall be reviewed at least once, five years following the date of delisting.
- 10.3 The department shall evaluate the necessity of changing the classification of the species being reviewed. The agency shall report its findings to the commission at a commission meeting. The agency shall notify the public of its findings at least 30 days prior to presenting the findings to the commission.

- 10.3.1 If the agency determines that new information suggests that classification of a species should be changed from its present state, the agency shall initiate classification procedures provided for in these rules starting with section 5.1.
- 10.3.2 If the agency determines that conditions have not changed significantly and that the classification of the species should remain unchanged, the agency shall recommend to the commission that the species being reviewed shall retain its present classification status.

10.4 Nothing in these rules shall be construed to automatically delist a species without formal commission action.

Recovery and management of listed species

11.1 The agency shall write a recovery plan for species listed as endangered or threatened. The agency will write a management plan for species listed as sensitive. Recovery and management plans shall address the listing criteria described in sections 3.1 and 3.3, and shall include, but are not limited to:

- 11.1.1 Target population objectives
- 11.1.2 Criteria for reclassification
- 11.1.3 An implementation plan for reaching population objectives which will promote cooperative management and be sensitive to landowner needs and property rights. The plan will specify resources needed from and impacts to the department, other agencies (including federal, state, and local), tribes, landowners, and other interest groups. The plan shall consider various approaches to meeting recovery objectives including, but not limited to regulation, mitigation, acquisition, incentive, and compensation mechanisms.
- 11.1.4 Public education needs
- 11.1.5 A species monitoring plan, which requires periodic review to allow the incorporation of new information into the status report.

11.2 Preparation of recovery and management plans will be initiated by the agency within one year after the date of listing.

- 11.2.1 Recovery and management plans for species listed prior to 1990 or during the five years following the adoption of these rules shall be completed within 5 years after the date of listing or adoption of these rules, whichever comes later. Development of recovery plans for endangered species will receive higher priority than threatened or sensitive species.
- 11.2.2 Recovery and management plans for species listed after five years following the adoption of these rules shall be completed within three years after the date of listing.
- 11.2.3 The agency will publish a notice in the Washington Register and notify any parties who have expressed interest to the department interested parties of the initiation of recovery plan development.
- 11.2.4 If the deadlines defined in sections 11.2.1 and 11.2.2 are not met the department shall notify the public and report the reasons for missing the deadline and the strategy for completing the plan at a commission meeting. The intent of this section is to recognize current department personnel resources are limiting and that development of recovery plans for some of the species may require significant involvement by interests outside of the department, and therefore take longer to complete.

11.3 The agency shall provide an opportunity for interested public to comment on the recovery plan and any SEPA documents.

Classification procedures review

12.1 The agency and an ad hoc public group with members representing a broad spectrum of interests, shall meet as needed to accomplish the following:

- 12.1.1 Monitor the progress of the development of recovery and management plans and status reviews, highlight problems, and make recommendations to the department and other interested parties to improve the effectiveness of these processes.
- 12.1.2 Review these classification procedures six years after the adoption of these rules and report its findings to the commission.

Authority

- 13.1 The commission has the authority to classify wildlife as endangered under RCW 77.12.020. Species classified as endangered are listed under WAC 232-12-014, as amended.
- 13.2 Threatened and sensitive species shall be classified as subcategories of protected wildlife. The commission has the authority to classify wildlife as protected under RCW 77.12.020. Species classified as protected are listed under WAC 232-12-011, as amended.

[Statutory Authority: RCW 77.12.040. 98-05-041 (Order 98-17), § 232-12-297, filed 2/11/98, effective 3/14/98. Statutory Authority: RCW 77.12.020. 90-11-066 (Order 442), § 232-12-297, filed 5/15/90, effective 6/15/90.]